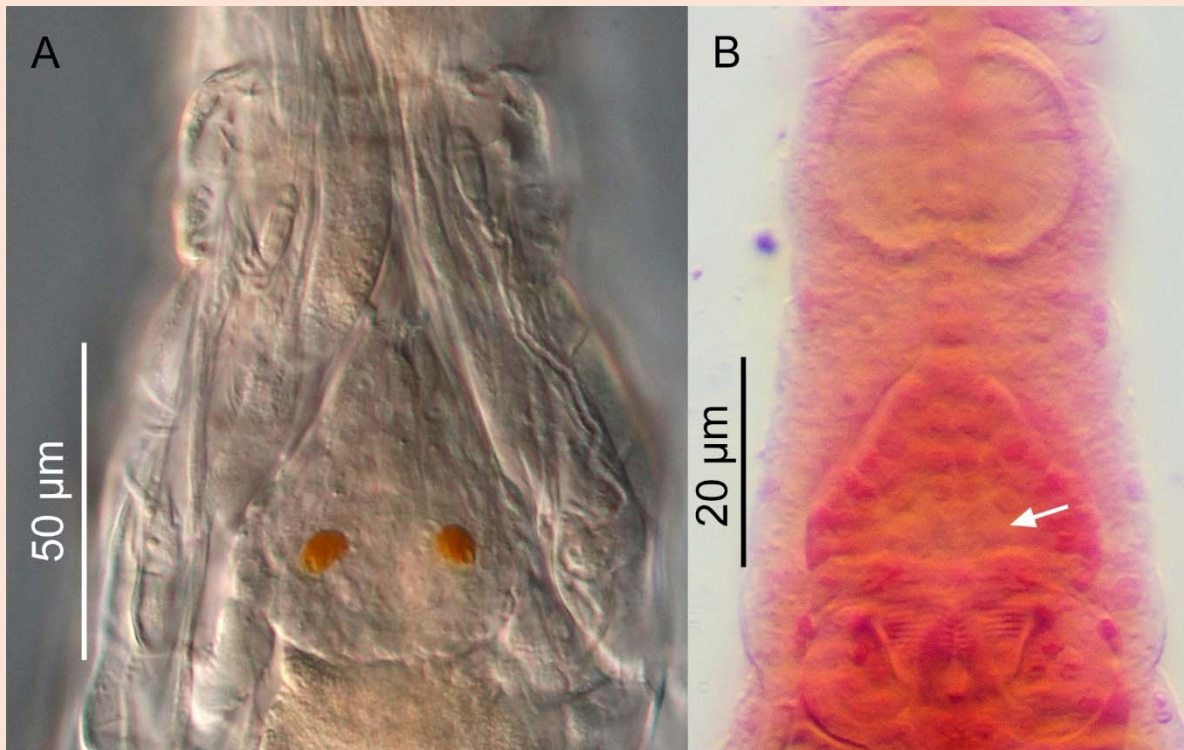


Rotifer News

A newsletter for rotiferologists throughout the world



Do rotifers have consciousness? See p. 5-8 by *Aydin Örstan*

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In this issue:

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Produced at the

National Autonomous University of Mexico (UNAM)-Faculty of Higher Studies (FES) Iztacala, Mexico

Editorial: In this issue

This issue covers several exciting aspects on different aspects of rotifers.

The updated information on the IRS-XVII (2025) is now available from Christina Wyss Castelo Branco, the Organizer of the event (Pages 2-3). An impressive emblem of the Rotifera XVII has been developed (Page 4).

Örstan has presented an interesting topic on the consciousness in rotifers (pages 5-8). The author believes that rotifers do not have consciousness, which, however, requires further investigation.

An international course with series of talks on the rotifers was organized during 9-13 September, 2024 with the financial support from the National Autonomous University of Mexico (see Report on pages 9-10).

Young rotiferologists are sometimes unaware of the significant contributions made by giants in rotifer research. To recognize the importance of this, S. Nandini initiated the laboratory seminars on presenting significant works done by well-known rotiferologists. The presentations are made by students at different levels, from undergraduate to postdoc, who search literature for significant works on rotifers and present short talks on them (see Page 11, this issue). In the future seminars of our laboratory, information about other giants in rotifer research will be presented.

The final issue of the proceedings of Rotifera XVI in Hydrobiologia (vol. 851, issue 12-13) has been released during June, 2024. This issue carries 30 works including a preface and a correction.

The other themes covered in this issue are the notes and news and some recent literature on rotifers. Augustus Mamaril fondly recalls his mentor, late CH Fernando (Page 12).

During our zooplankton sample analysis, we found a rare brachionid individual. This is an ovigerous female of *Brachionus* sp. The species appears to be closely related to *Brachionus calyciflorus* Pallas (Page 12).

A new book from the Centro de Ciencias Básicas of Universidad Autónoma de Aguascalientes (Aguascalientes, Mexico) is available for broad-based researchers in aquatic biology (Pages 13-14).

Contributions from the Editorial Board Members of RN are invited for the future issues.

The next RN issue (No. 44) will be expected during January 2025 or later.

S.S.S. Sarma
Editor

Announcement

XVII International Rotifer Symposium, 4-8 August, 2025, Rio de Janeiro, Brazil

Dear Rotifer family,
We invite everyone to attend the XVIIth International Rotifer Symposium, which will be held in Rio de Janeiro, Brazil, from August 4th to 8th, 2025. A team from Brazil (Federal University of the State of Rio de Janeiro, State University of Maringá), Argentina (INALI), Venezuela (University Central de Venezuela), and Uruguay (University of La Republica) are organizing the meeting.

However, for the first time the symposium will be held in the Southern Hemisphere. The theme of IRS XVII is "Challenges for the study of rotifers in the Southern Hemisphere." Brazil is the largest tropical country in the world, harboring a remarkable freshwater biodiversity. Given that the Neotropics is among the least-studied major ecoregions of the world, many challenges exist for study of its biodiversity. These include aquatic ecosystems with different characteristics such as (1) the large Amazon basin, (2) the Pantanal, (3) other large rivers, (4) forest and temporary rivers, and (5) coastal lakes and lagoons. Since the last century

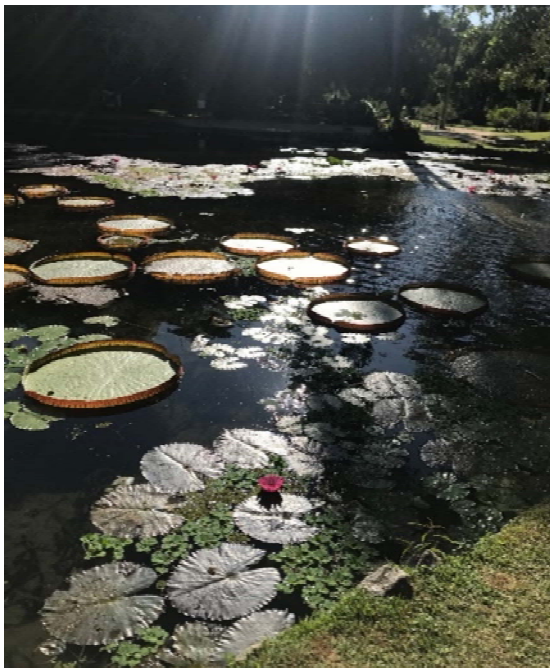


Photo 1a (left): The giant waterlily, *Victoria regia*, in a local botanical garden; 1b (right): View of the Christ from the Botanical Garden.

This symposium continues the decades-old tradition of gathering rotiferologists from around the world to attend a weeklong congress.

several rotiferologists have explored localities in Brazil; these researchers include Bonecker, Dumont, José de Paggi, Koste, Murray, Segers, and



Photo 2a (left): Rodrigo de Freitas Lagoon; 2b (right): Natural fauna and flora in the lagoons of the Baixada de Jacarepaguá

Turner. Nevertheless, despite their efforts extensive surveys are lacking, and major waterbodies remain essentially unexplored.

The XVIIth International Rotifer Symposium will be at the Rio Othon Palace Hotel, located in Copacabana beach, in a very pleasant area of the southern part of the City of Rio de Janeiro. It will be wintertime in Rio, and based on the tourism score this is the best time of year to visit the city. The region favors clear, rainless days with temperatures ranging between 65° and 80° F. We are planning middle conference excursions “from rainforest to coastal lagoons” (Photos 1-2), as

well as excursions before or after the event. Because several interesting sites are located close to the city of Rio de Janeiro, we anticipate being able to offer a few round-trip options lasting two or three days.

We invite all to participate in symposium activities. Applications for Workshops, special sessions, and pre-conference courses will be welcome. More details will be added in July 2024.

Christina Wyss Castelo Branco
Organizer, **Rotifera XVII, 2025**

E-mail: <cbranco@unirio.br>

**First Circular. Rio de Janeiro, Brazil,
from August 4th to 8th, 2025**



Dear Colleagues,

We invite all researchers interested in rotifers to the next XVII International Rotifer Symposium, to be held in the city of Rio de Janeiro, Brazil, from August 4th to 8th, 2025.

The meeting will be hosted and organized by the Federal University of the State of Rio de Janeiro (UNIRIO) and supported by professors from the Federal University of Rio de Janeiro (UFRJ), the State University of Maringá (UEM), and universities from Argentina, Ecuador, Uruguay, and Venezuela.

With the theme “*Challenges for the Study of Rotifers in the Southern Hemisphere*”, the symposium will bring together professors, scientists, technicians, and students to discuss numerous scientific issues related to research with Rotifers. So far, 14 countries have hosted these symposia that began in 1977 (Austria (twice), Belgium, Italy, Poland, Spain, Sweden, United Kingdom, United States (twice), Thailand, Mexico, Germany, Czech Republic, India, and Croatia). The *XVII International Rotifer Symposium* will be the first to be held in the Southern Hemisphere. The worsening scenario of water resource scarcity, due to its uses and climate

change, has sparked worldwide interest in this resource and special attention to its aquatic communities. Rotifer fauna is ubiquitous in water systems on the continents, playing an important role in the local food web and serving as a bioindicator of environmental quality and used in aquaculture and ecotoxicological tests. International symposia have historically been an important forum for presenting recent research on rotifers, exchanging knowledge and providing important stimuli for students and researchers. As in previous symposia, authors of presentations may submit their complete papers for publication free of charge in *Hydrobiologia*.

The XVII International Rotifer Symposium will be held at UNIRIO, which is located in Urca, a very pleasant area of the south part of the city of Rio de Janeiro near the Sugar Loaf. The Organizing Committee of the symposium invites you to access the symposium's social media and to plan your coming to Rio to attend the event. Suggestions of topics for discussion or other information, please sent to email rotifera2025@gmail.com

Organizing Committee

XVII International Rotifer Symposium

Christina Wyss Castelo Branco
Organizer, **Rotifera XVII, 2025**

E-mail: < rotifera2025@gmail.com >

Notes on Rotifer Biology

Do rotifers have consciousness?

In April 2024 a group of scientists published online The New York Declaration on Animal Consciousness (NYDAC; Andrews, et al. 2024). NYDAC consists of three statements, the second of which reads:

"... the empirical evidence indicates at least a realistic possibility of conscious experience in all vertebrates (including reptiles, amphibians, and fishes) and many invertebrates (including, at minimum, cephalopod mollusks, decapod crustaceans, and insects)."

After reading this, I started wondering whether our favorite animals, rotifers, could possibly have any experiences that may qualify as consciousness. But first, what is consciousness? In its brief answer to this question, NYDAC seems to equate being conscious with having "subjective experiences" (Andrews, et al. 2024):

"This can include sensory experiences (say, the experience of a particular touch, taste, sight, or smell), as well as experiences that feel good or bad (say, the experience of pleasure, pain, hope, or fear)."

Sensory experiences require, first, sensory organs receiving input from the external environment and, second, a brain to process the sensory input for the development of experiences. So these two must be the minimum hardware requirements for consciousness to develop.

Because my knowledge of rotifers is limited almost exclusively to bdelloids, I will restrict my discussion to them. Bdelloids have a nervous system, various sensory organs, as well as a cerebral ganglion that has traditionally been referred to as a brain (Clément, et al., 1983). They can detect the chemicals in their environment and respond to touch. A number of bdelloid species also have eyes. Early investigators thought that the eyes of rotifers had lenses (Hudson & Gosse, 1889), which would imply that they could form images. However, subsequent studies, especially those using electron microscopes, showed that rotifer eyes lacked lenses (Clément, et al., 1983; Clément & Wurdak, 1991). In *Philodina* the eyes are on the dorsal surface of the brain below the integument; even if they had lenses, they could not form clear images (Figure 1A). Each eye of *Philodina* consists of an epithelial cell containing pigment granules in close contact with a nerve ending (Clément & Wurdak, 1991). Apparently, they are there to simply detect light, but *Philodina* was said to exhibit no phototaxis (Clément, et al., 1983). Species with and without eyes often coexist in spatially simple habitats containing very small volumes of water, for example, rock holes (Örstan, 2023). Therefore, it is not clear what bdelloids can do with the information they receive from their eyes.

In summary, bdelloids have sensory organs and brains and, thus, satisfy the hardware requirements for consciousness. But do they actually have consciousness? In a paper

published in 1894, James Weir, Jr., an American physician, speculated that the microscopic animals he had been observing under his microscope had "their pastimes and amusements." He described the behavior of a rotifer, possibly a bdelloid, as follows (Weir, 1894):

"This rotifer goes through another performance which I also believe to be simply a pastime. Its tail is armed with a double hook or forceps. It attaches itself to a piece of alga or other substance by this forceps, and then moves its body up and down in the water for several minutes at a time."

If Weir's speculations were true, they would certainly imply presence of consciousness in rotifers. However, Weir's attempts at anthropomorphizing had no sound basis. He was describing either the rotifer's ordinary feeding behavior or its response to some external stimulus.

Bumblebees, which have been listed among invertebrates that possibly have some sort of consciousness (Andrews, et al. 2024), have brains containing more than 4×10^5 cells divided into multiple components (Gowda & Gronenberg, 2019). In comparison, the brain of a bdelloid consists of only about 300 cells with a neuropil in the center (Brakenhoff, 1937; Clément & Wurdak, 1991). One cannot discern any other subdivisions within the bdelloid brain either with a light or an electron microscope (Figure 1B).

The sensation of physical, as well as emotional pain, probably contributes to the development of consciousness (Andrews, et al. 2024). Sensory organs detect external stimuli such as chemicals and photons. In contrast, "pain" is not something that exists outside an organism; it is an internal response to a sensory input that reaches a dangerous level, such as an acidic chemical that is destroying cells. I would think that to feel pain an organism would need a fairly complex brain for the appropriate processing of the information incoming from its sensory organs.

Can rotifers feel pain? I once filmed a bdelloid recovering from anhydrobiosis. As the bdelloid was rehydrating, its body fluid started to leak through a small puncture wound it happened to have in its integument (Figure 2). We would assume a vertebrate with a similar injury would feel pain and recognize its behavioral symptoms, at least in animals that are familiar to us. The bdelloid I was observing displayed no unusual behavior that I could have associated with pain. Nor was there any indication that it was aware of its injury. Based on this limited and circumstantial evidence, I am assuming rotifers do not feel pain.

The sensory organs of rotifers indeed fulfill their most basic evolutionary needs by responding to common external stimuli, but their brains are not complex enough for the generation of subjective experiences, including pain.

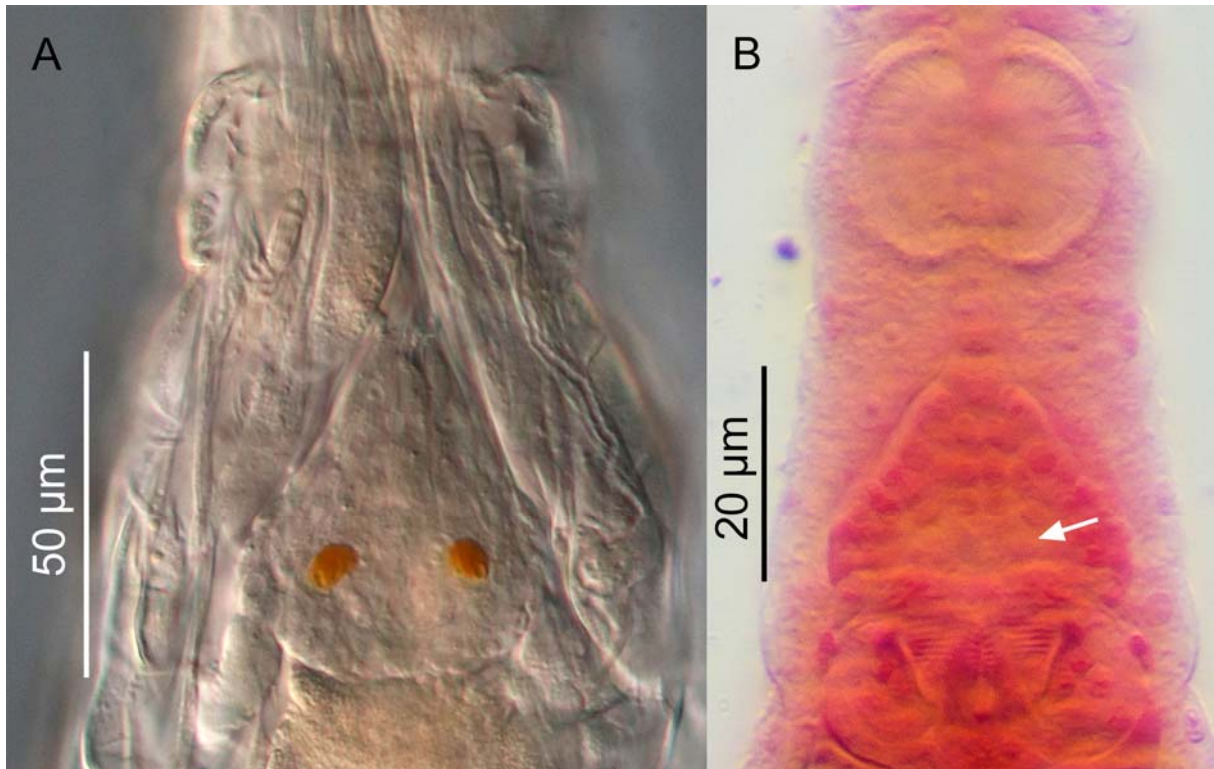


Figure 1. A. The eyes of *Philodina monstrosa* Örstan, 2022 on its pear-shaped brain. **B.** The brain of a preserved and stained specimen of *Otostephanos* sp. Individual nerve cells and the posterior neuropil (arrow) are visible.

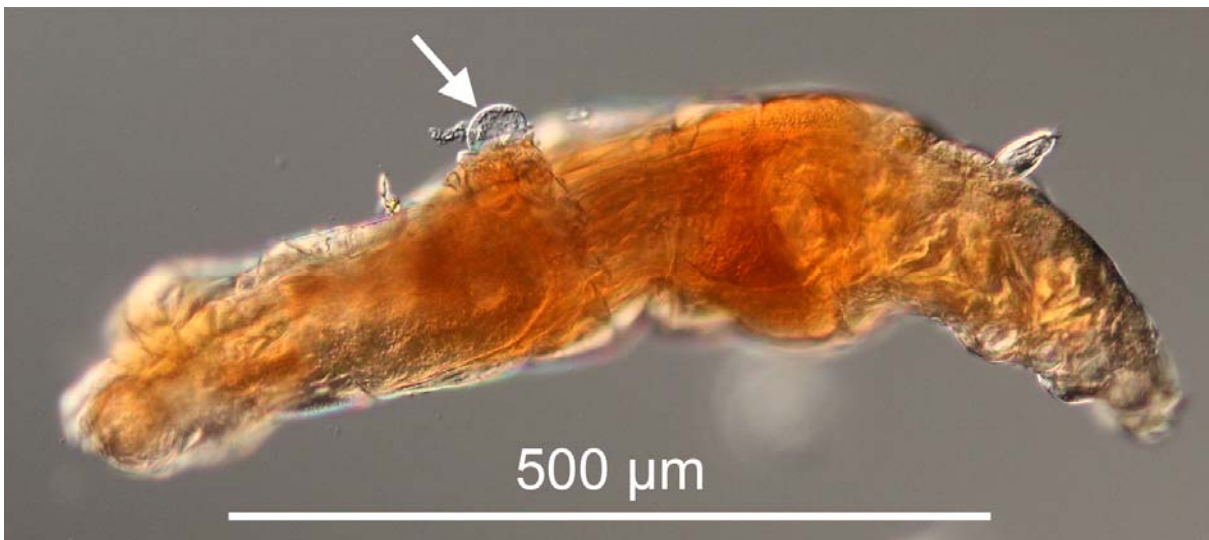


Figure 2. A live *Philodina monstrosa* soon after it recovered from anhydrobiosis. During rehydration its body fluids temporarily leaked from a small puncture wound that was quickly repaired (arrow). There was no indication in the animal's behavior during that period that it was in distress.

Therefore, the answer I am offering to the title question of this article is that I don't think rotifers have consciousness.

Note added by the editor. While Aydin has provided a negative answer to his question, he advances an important point. We do know a good deal about rotifer behavior, but our understanding of the rotifer connectome comprises a knowledge gap that is worthy of serious investigation (Wallace et al. 2024).

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Aydin Örstan

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International Course and Invited talks
at FEI Iztacala, UNAM Mexico: 9-13
September, 2024



UNAM
POSGRADO
Ciencias del Mar y
Limnología



IZTACALA

Curso

“Applied Taxonomy exemplified by recent advances in Rotifer Taxonomy, and its use and Implications for Biodiversity Conservation and Sustainable use”

Del 9 al 13 de Septiembre de 2024
Centro Cultural, FES-Iztacala de 12:00 a 16:00 hrs.



Dr. Hendrik Segers
Royal Belgian Institute of
Natural Sciences.
Embajador y representante
Nacional de Bélgica en el
Convenio sobre Diversidad
Biológica

Temas:

- State of the art of rotifer taxonomy, with special focus on knowledge gaps
- Why study rotifers? An overview of the unique features of the group, and their significance
- The convention on biological diversity and other multilateral environmental agreements related to biodiversity
- An introduction to the intergovernmental science-policy platform on biodiversity and ecosystem services (IPBES)
- How to engage in (international) biodiversity governance as a scientist?

Registro previo / No Fotos / No Video
Sesiones de Práctica con Cupo Limitado

Organizadores Dra. S. Nandini y Dr. S. S. S. Sarma
e-mail: nandini@unam.mx ; Informes Tel.: 5556231125, 5556231256, 5556231155

There are also four other invited talks: 1. Contribution of Training Courses to the increase in our knowledge of Biodiversity-A case study on Zooplankton Studies in Mexico by **HJ Dumont**; 2. Information on Superorder Gnesiotrocha by **RL Wallace**; 3. Contribución del Órgano Científico a la COP e implementación del Convenio de la Diversidad Biológica en México by **Hesiquio Benitez** and 4. Rotifer Research in a Molecular Age by **EJ Walsh**.

An international course, *Applied Taxonomy exemplified by recent advances in Rotifer Taxonomy, and its use and Implications for Biodiversity Conservation and Sustainable Use*, with selected invited talks on biodiversity and the taxonomy of rotifers was organized in FES Iztacala, UNAM, Mexico with institutional financial support (PAEP, Posgrado en Ciencias del Mar y Limnología and FES Iztacala). The main subject expert was Hendrik Segers from the Royal Belgian Institute of Natural Sciences.

This course had both theoretical and practical sessions. While the talks were open to registered participants (online and offline), the practical part was open to young undergraduate and postgraduate students interested in rotifer research. There were more than 80 participants from Mexico, USA, Peru and India.

The course was inaugurated by the Director of FES Iztacala, María del Coro Arizmendi Arriaga (Fig. 1). Hugo Virgilio Perales Vela (Fig. 2 second photo from left to right), Head of the Biological Sciences of FESI, spoke about the importance of such courses/talks for the teaching and research activities of our university.

The invited speakers also included HJ Dumont, RL Wallace, Hesiquio Benitez (Fig. 3, left photo) and EJ Walsh. During the practical session, participants shared imaged of selected rotifer species for confirmation / identification. Kalpana Pai shared her interesting contributions on rotifer species diversity from Western Ghats (India). Majority of talks were in

English. Simultaneous translation of talks into Spanish was done by Padmini Singaraju Sarma (Fig. 4, right photo).



Figure 1

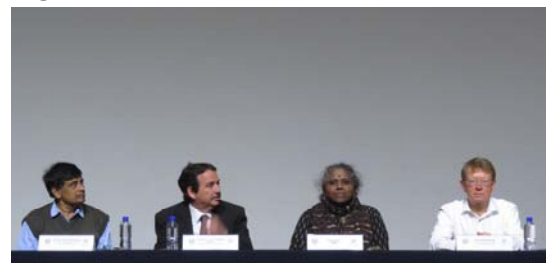


Figure 2



Figure 3



Figure 4

S. Nandini
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Notes and News: Intra-laboratory seminar

Awareness of significant contributions by giants in rotifer research. Some prominent rotifer researchers and their works presented by students our laboratory.



1. **Roger Pourriot** by Sergio González Gutiérrez; 2. **George Evelyn Hutchinson** by Sara María Castillo Morales; 3. **Birger Pejler & Bruno Bērziņš** by Emelio Eleazar Gordillo Romero; 4. **Claudia Ricci & Giulio Melone** by Rosa Martha Moreno Gutiérrez; 5. **Elizabeth J. Walsh** by José Antonio Hernández Lucero; 6. **Russell J. Shiel** by Cándido Israel Luna González; 7. **Robert L. Wallace** by José Ángel Quiroz Miranda; 8. **Diego Fontaneto** by Carlos Sánchez-Zamora; 9. **Hendrik Segers** by Ronaldo Carlos Reynoso Trejo Bonequi; 10. **Manuel Serra Galindo** by Leticia Esmeralda Cruz-Escalante; 11. **Henri J. Dumont** by José Rodolfo Bonfil Campos; 12. **John J. Gilbert** by Ana Nayeli López Rocha; 13. **Terry W. Snell** by Diana Verónica Meneses Arcos.

Tribute: CH Fernando

**A tribute
to one of the greatest mentors I've ever had**

**He taught me to love
those tiny beasts in freshwaters.**

Prof. Dr. CONSTANTINE HERBERT FERNANDO
(1929—2018)
*Professor in the Department of Biology
University of Waterloo, Ontario, Canada*



C. H. Fernando or 'Herbert' (his PhD was from Oxford, UK) was my MSc Biology adviser on freshwater zooplankton (rotifers, Cladocera, and Copepoda) of the Philippines beginning in September 1975 through May 1977 at the University of Waterloo.

In 1975-1976, he was also my professor in two year-long graduate courses: *Entomology* and *Advanced Limnology*

Herbert 'guarded' me, man-to-man, while I examined the plankton samples I brought over from the Philippines. I was the only Filipino in his lab having been sent to him by his friend, the eminent fish helminthologist Dr. Carmen C. Velasquez, who was later bestowed the highest honor in science in the Philippines with the title '*National Scientist*'.

Various accents rang in Herbert's lab.

Herbert's other graduate students were from **Malaysia** (Richard Lim and Guat Lian 'Irene' Chan), **India** (Reginald 'Regi' Victor and Ramachandran 'Rama' Chengalath), and **Canada** (Beverly 'Bev' Hicks and Brenda Hahn).

The postdocs were **Dr. Hoi Chaw Lai** of Malaysia for freshwater calanoids and **Dr. Tamas Hamor**, a refugee from Hungary, who did reservoir fish studies. Once in awhile, Sri Lanka-born Herbert gleefully served us the spiciest foods he could come up with (*but which burned my tongue*).



Herbert was at work in his office-library in the second floor of the biology building even on Sundays. He gave a key to us, his own graduate students, so we could photocopy references that he had in his room. He let us use his xerox cartridge in the department photocopying machine.

What was the very first lesson about zooplankton that I learned in Canada?

It was a day in September in the Fall Term of 1975 when I first stepped foot in the Department of Biology of the University of Waterloo in Ontario, Canada. Along the corridor, just outside of the department office, I ran into the dreaded over-all graduate adviser of the biology department, the young Dr. Stephen M. Smith. He asked what I was there for. He told me in a loud voice, "**To study freshwater zooplankton, one must have a great capacity to get bored.**" That was the welcome ritual from the 'Herr' Smith, who later became a member of my MSc thesis committee and also my stern and very organized professor in Entomology.

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Notes & News: New email accounts

New readers and/or updated email accounts are added to RN

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Emily Harmon

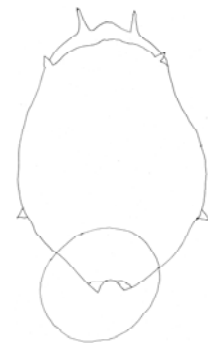
PhD candidate, UNC Chapel Hill, David Pfennig lab

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Rare Brachionid rotifer observed

During the routine zooplankton collected from the Lake Xochimilco (25 Sept. 2024), a rare brachionid rotifer (see the photo below) was observed. It was an egg-bearing female with length about 150 μm . The anterior spines 4 with wide base giving the resemblance to *Brachionus cf. calyciflorus*.



S.S.S. Sarma
S. Nandini

Notes and News: *New book from Aguascalientes (Mexico)*

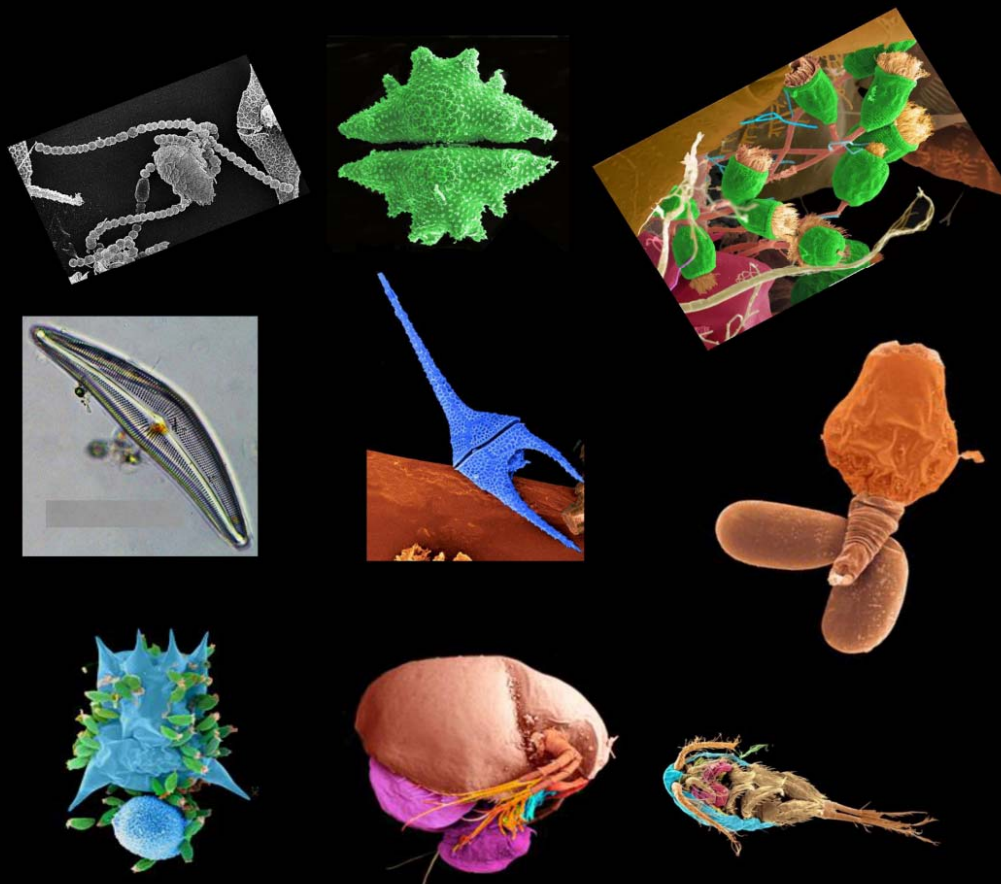


ISBN No: 978-1-946628-14-5

Some examples of Algae, Protists and Invertebrates from Aguascalientes State, México
Algunos ejemplos de Algas, Protistas e Invertebrados del estado de Aguascalientes. México

Marcelo Silva Briano, Araceli Adabache Ortiz & Vianney Beraud Macías, and collaborators.

Universidad Autónoma de Aguascalientes, MÉXICO.



**International Journal of Environmental
Sciences & Natural Resources.**

Some examples of Algae, Protists and Invertebrates of Aguascalientes State, México / Algunos ejemplos de Algas, Protistas e Invertebrados del estado de Aguascalientes. México.

Marcelo Silva Briano, Araceli Adabache Ortiz & Vianney Beraud Macías

Collaborators:

Ana Ekaterina Retes Pruneda, Jaime Antonio Escoto Moreno, Frida Sabine Álvarez Solís, Rocío Natalia Armas Chávez, Aleksandra Baquero Mariaca, Leslie Darlene Serrano, Porfirio Jassiel López Hernández, Ángel Alcalá Pavia, Martín Carlos González Alcalá, Vianney Beraud Macías, Fernanda Calderón, María Fernanda Cabrera Cabral, Alejandro Jesús Galicia Zacarías, Ana Valeria Árias Magaña, Mireya del Rocío Hernández Villalobos.

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Prologue

In Aguascalientes state, Mexico, water bodies host a freshwater diversity of algae, protists and invertebrates that are invisible to the human eye due to their small dimensions. Among the invertebrates, there are three main groups of zooplankton: Rotifera, Cladocera and Copepoda. Some species of these three groups have been reported as new to science and endemic.

Some Rotifera species are new for science, and they are included in this work. In our E-Book, rotifers are an important part of this presentation of the wonderful microscopic world of the state's water bodies.

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